



ESD

Exploration Systems Development

Combined Monthly Report May 2016

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National Aeronautics and
Space Administration



ORION

MAY 2016

PERFORMANCE UNDER PRESSURE

A large, green, conical Orion crew module is suspended by a yellow crane in a large industrial facility. Several technicians are visible around the module, some standing on the floor and others on ladders. The facility has high ceilings, large windows, and various pieces of equipment like carts and ladders.

Lockheed Martin engineers and technicians prepare the Orion crew module for a series of tests inside the proof pressure cell in the Neil Armstrong Operations and Checkout Building at NASA's Kennedy Space Center in Florida.

ORION SPACECRAFT PASSES PRESSURE TEST SERIES

Engineers at NASA's Kennedy Space Center in Florida recently completed a series of pressure tests on the Orion crew module. The tests confirmed that the weld points of the underlying structure, called the pressure vessel, will protect astronauts during the launch, in-space, re-entry and landing phases of spaceflight.

Orion's pressurized crew module contains the atmosphere that a crew would breathe during a mission. It is also the living and working space for the crew and must withstand the loads and forces experienced during launch and landing.

Orion was tested inside the proof pressure cell in the high bay of the Neil Armstrong Operations and Checkout Building. Lockheed Martin, the manufacturer of the Orion crew module, ran the test at incremental steps over two days to reach the maximum pressure. During each step, the team pressurized the chamber and then evaluated the data

to identify changes for the next test parameter. The results revealed the workmanship of the crew module pressure vessel welds and how the welds reacted to the stresses from the pressurization.

Future tests at Kennedy will include a launch simulation and power-on procedure. Orion and its service module also will be sent to NASA Glenn Research Center's Plum Brook Station facility in Sandusky, Ohio, for acoustics and vibration tests.

NASA's Space Launch System will launch Orion on its next flight, Exploration Mission 1 (EM-1), when the spacecraft will travel beyond the moon and back on an uncrewed flight test.

[Read the full story about the pressure test series.](#)

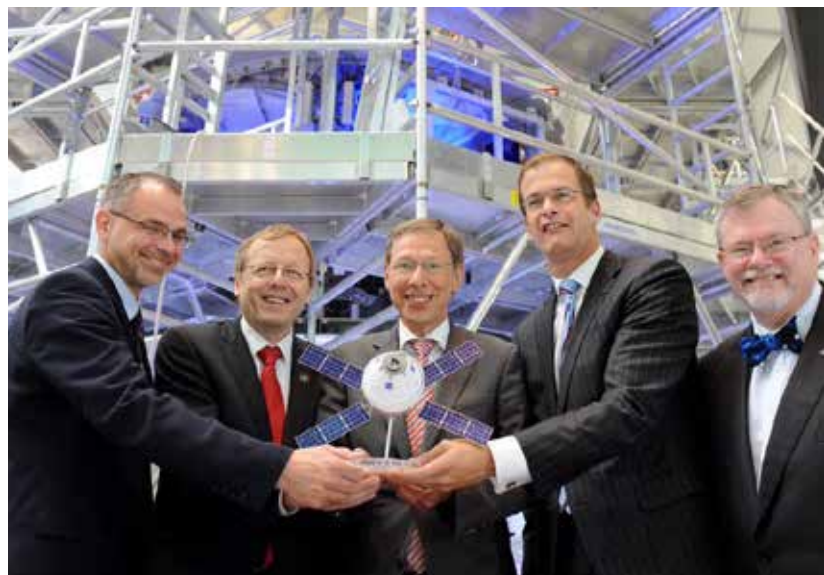
A press conference in Germany marks the arrival of the EM-1 flight structure to Bremen and the start of the assembly by Airbus.



ORION SERVICE MODULE ASSEMBLY UNDERWAY AT AIRBUS

Airbus Defence and Space, the world's second largest space company, began assembling the European-built service module for Exploration Mission-1. The service module sits below the crew module and is known as the powerhouse of NASA's next-generation Orion spacecraft.

After the arrival of the flight model structure from Thales Alenia Space Italy, final assembly will be carried out at Airbus Defence and Space's site at Bremen, Germany, where officials from ESA (European Space Agency), NASA, Airbus Defence and Space and partners gave an update on the Orion program's progress on May 19.



Shown in photo from left to right: Jim Free (NASA), Jan Wörner (ESA), Carsten Sieling (Lord Mayor Bremen), Bart Reijnen (Airbus) and Michael Hawes (Lockheed Martin).

Integrating more than 20,000 parts and components in the flight model ranging from electrical equipment to rocket engines, solar arrays, tanks for propellant and life support consumables as well as hundreds of meters of cables and tubes marks a major milestone for the Orion program.

Continued on next page >

Airbus Defence and Space was chosen by ESA as the prime contractor to develop and build the service module, which will supply propulsion, power, thermal control, air and water for astronauts on missions beyond the moon and to Mars.

In managing the development and construction of the module, Airbus Defence and Space is drawing on its extensive experience as prime contractor of ESA's Automated Transfer Vehicle, which made regular deliveries of experiment equipment, spare parts, food, air and water for the crews on board the International Space Station.

[Read the full story about the Orion assembly.](#)

On the right, the primary structure for the Exploration Mission-1 service module is prepared for final assembly at the Airbus Defence and Space facility in Bremen, Germany.

Picture below, Oliver Juckenhöfel, head of the Orion European service module for Airbus Defence and Space hosted 170 team members across the program to exchange information, provide a status of the program, and work on quality and team building. Team members are from Les Mureaux, France; Lampoldshausen & Bremen, Germany; and the United States.





Orion and SLS industry representatives discuss the technologies in place today that are capable of safely transporting humans to Mars and back to Earth.

D.C. SUMMIT SETS SITES ON MARS

NASA, industry, policy figures, entertainment industry representatives and STEM education professionals presented perspectives on the future of human space exploration beyond the Earth and moon at the Humans to Mars Summit held May 17-19 at George Washington University in Washington.

Over the course of three days, the summit featured discussions about the technical, scientific, policy and public outreach challenges associated with the goal of sending humans to Mars. Speakers included Ellen Stofan, NASA chief scientist; Wanda Sigur, Lockheed Martin vice president of the civil space line of business; Tony Antonelli, Lockheed Martin exploration chief technologist; Andy Weir, author of *The Martian*; Buzz Aldrin, former Apollo astronaut; Abigail Harrison (Astronaut Abby) of The Mars Generation; and many others.

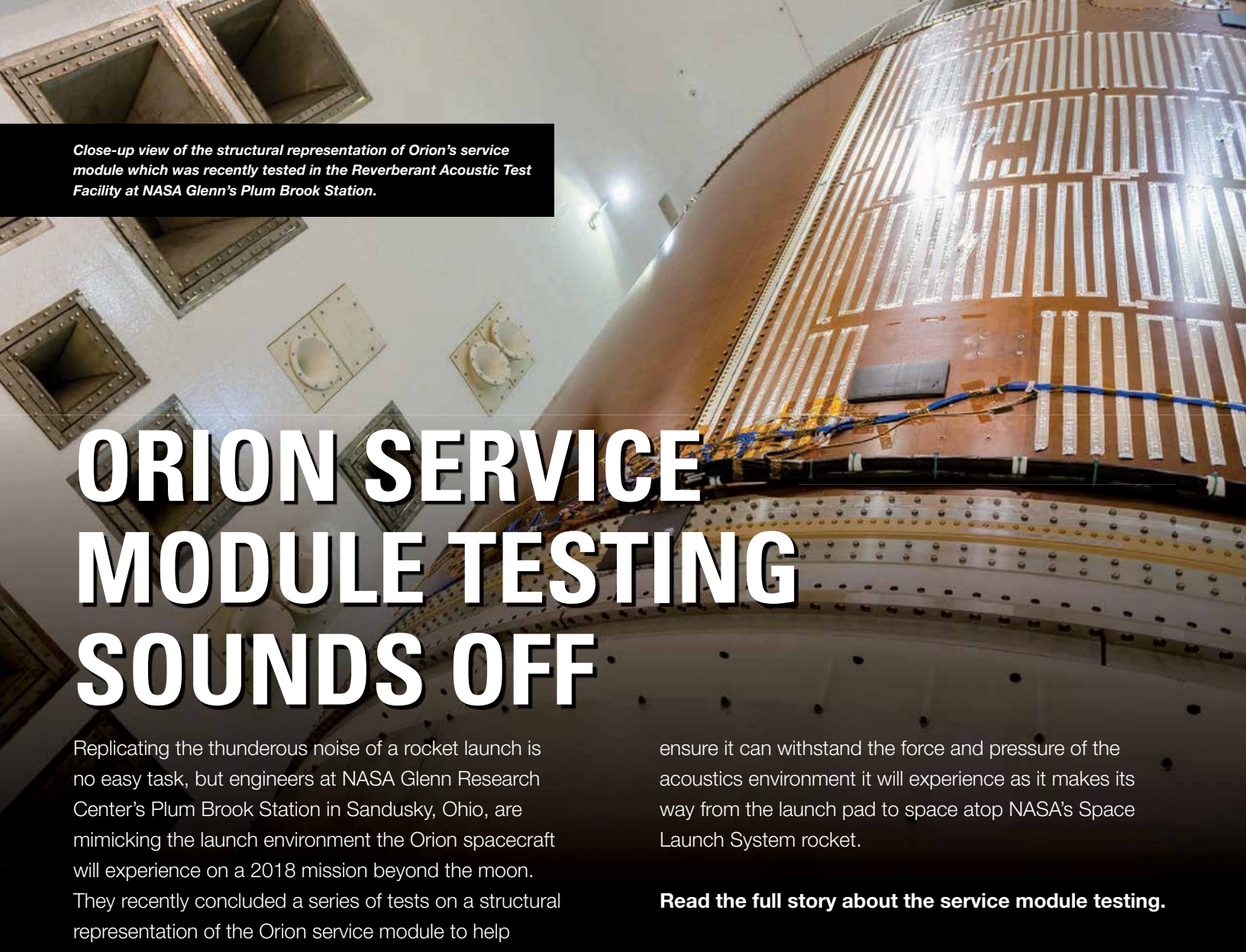
Several mission concepts for interplanetary transportation and Mars surface systems were presented during the conference. During the Vision to Reality: Human Exploration of Mars panel, Tony Antonelli unveiled the Lockheed Martin Mars Base Camp mission concept for sending humans to Mars by 2028. The Mars Base Camp

concept is built on a strong foundation utilizing today's technologies – making it safe, affordable and achievable:

- > **Orion:** The world's only deep-space crew capsule, built with long-duration life support, deep-space communications and navigation, and safe Earth reentry capability.
- > **Space Launch System:** The rocket with super heavy lift capability to send critical labs, habitats and supplies to Mars.
- > **Habitats:** Building on NextSTEP research, deep space habitats will give astronauts room to live and work on the way to, from and at Mars.
- > **Solar Electric Propulsion:** Based on technology already in place on satellites, this advanced propulsion can pre-position key supplies in Mars orbit.

Read the Popular Science article about Mars Base Camp.

Watch a replay of Humans to Mars presentations.



Close-up view of the structural representation of Orion's service module which was recently tested in the Reverberant Acoustic Test Facility at NASA Glenn's Plum Brook Station.

ORION SERVICE MODULE TESTING SOUNDS OFF

Replicating the thunderous noise of a rocket launch is no easy task, but engineers at NASA Glenn Research Center's Plum Brook Station in Sandusky, Ohio, are mimicking the launch environment the Orion spacecraft will experience on a 2018 mission beyond the moon. They recently concluded a series of tests on a structural representation of the Orion service module to help

ensure it can withstand the force and pressure of the acoustics environment it will experience as it makes its way from the launch pad to space atop NASA's Space Launch System rocket.

[Read the full story about the service module testing.](#)



Engineers at NASA's Langley Research Center in Hampton, Virginia, dress a 105-pound representative female crash-test dummy into a modified Advanced Crew Escape Suit to prepare for water-impact testing at Langley's 20-foot-deep Hydro Impact Basin.

NASA CRASH-TEST DUMMIES SUIT UP FOR ACTION

Engineers at NASA's Langley Research Center in Hampton, Virginia, are working to ensure astronauts are safe during splashdown by performing water-impact tests of an Orion test capsule with suited crash test dummies inside.

- > **[Read about the crash-test dummies through NASA's website.](#)**
- > **[Read about the crash-test dummies through Lockheed Martin.](#)**



NASA representatives pose in front of the Ikhana aircraft at NASA's Armstrong Flight Research Center. The Ikhana remotely-piloted aircraft, which is based at Armstrong, was used to capture live video during the Orion re-entry and landing during Exploration Flight Test-1.

ARMSTRONG TEAM HONORED FOR EXCEPTIONAL ORION WORK

NASA's Orion program representatives visited NASA Armstrong Flight Research Center in California to honor employees' contributions and talk about the space program.

Charlie Lundquist, NASA Orion deputy program manager; C.J. Johnson, Orion project manager for the Capsule Parachute Assembly System (CPAS); Ann Bufkin, Orion CPAS test engineer; and Barbara Zelon, Orion program communications manager, were briefed about the center's support of the Orion program during their visit.

During the award ceremony, Lundquist presented Armstrong Deputy Director Patrick Stoliker with an American flag that was flown aboard the Orion spacecraft during the Exploration Flight Test-1 mission.

To support CPAS, Armstrong provides air-to-air aircraft imagery and chase plane support for the C-17 air launch of the system tested at the U.S. Army's Yuma Proving Ground. Photography and videography is used for test reconstruction and parachute performance photogrammetric analysis.

NASA Armstrong is supporting Orion launch abort system flight test development, including preparations for the AA-2 flight test in 2019. Armstrong will provide development flight instrumentation for AA-2 and manages the NASA contract for the Abort Test Booster for the AA-2 launch.

[Read the full story about the Armstrong Team.](#)



Orion employees at the Neutral Buoyancy Laboratory

JSC EMPLOYEES VIEW A PART OF EFT-1 HISTORY

NASA's Johnson Space Center employees had the opportunity to view a traveling Exploration Flight Test-1 exhibit that is traveling to each of the NASA center. On display were two items flown aboard Orion's historic first flight test on Dec. 5, 2014: a written piece by Dr. Maya Angelou, "A Brave and Startling Truth," and a U.S. flag presented to NASA on behalf of Lockheed Martin.



Orion team in front of building 17



In the image above, Orion team members in the Mission Control Center. In the image below, Orion team in the Space Vehicle Mockup Facility.



SO-CAL CELEBRATES SPACE

On May 14, San Diego Composites, Inc. represented the Orion team at San Diego Air & Space Museum's 13th Annual Space Day Celebration. The celebration featured displays from aerospace organizations all over Southern California. SDC Vice President Ken Mercer said the event was a fun way to connect the Orion program with the San Diego Community. Employees gave students a hands-on experience and a chance to learn how today's advanced materials will help Orion venture out on missions deeper into space than ever before. San Diego Composites is a supplier to Lockheed Martin that manufactures several components for Orion's launch abort system, which propels astronauts to safety in the event of an emergency on the launch pad or during ascent to orbit.



EM-2 WORK HATCHED AT JSC

The Orion team completed engineering development unit vibration testing on the Exploration Mission-2 docking hatch at NASA's Johnson Space Center in Houston. The team also performed docking hatch swing/securing engineering evaluations in the full-scale Orion mockup on May 16 and 17.

In the picture, the Orion medium fidelity mockup at NASA's Johnson Space Center is being prepped for fit checks of the Exploration Mission-2 docking hatch.



SENATOR RUBIO TALKS SPACE WITH FLORIDA EDC GROUP

U.S. Senator Rubio (center) meets with community leaders from Brevard County, Florida.

Senator Marco Rubio (R-FL) met with Economic Development Commission (EDC) of Florida's Space Coast's Community Leaders group on May 11 in Washington. Joe Mayer, Lockheed Martin Space Systems government relations director for Florida, led the aerospace delegation discussions on the importance of

U.S. leadership in space, deep-space exploration with Orion and the Space Launch System, and preserving America's assured access to space. The Brevard County EDC group also held meetings with Senator Bill Nelson (D-FL) and Rep. Bill Posey (R-FL-8), as well as senior Air Force and Navy officials.



A IS FOR ASCENT

The Orion Ascent Abort-2 (AA-2) Crew and Separation Ring (CSR) team viewed the Orion boilerplate crew module at NASA Langley Research Center's fabrication facility this month. The CSR team is modifying and completing the boilerplate with the necessary systems to support the flight test objectives. Once complete, the vehicle will be shipped to NASA's Kennedy Space Center in Florida to support the AA-2 flight scheduled for December 2019.



PREPARING AMERICA FOR DEEP SPACE EXPLORATION: SOME ASSEMBLY REQUIRED

[Watch the full video.](#)



FOLLOW THE PROGRESS OF NASA'S NEW SPACECRAFT FOR HUMAN EXPLORATION:

NASA's Orion Blog[Blogs.NASA.gov/Orion](http://blogs.nasa.gov/Orion)

Twitter[Twitter.com/NASA_Orion](https://twitter.com/NASA_Orion)

Facebook[Facebook.com/NASAO Orion](https://facebook.com/NASAO Orion)

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UNIVERSITY STUDENTS TAKE ON THE NEXT MICRO-G CHALLENGE



Orion engineer Dustin Neill was one of several guest presenters for the "Journey to Mars" panel at a microgravity workshop held at NASA's Johnson Space Center. Called Micro-g Neutral Buoyancy Experiment Design Teams (Micro-g NEXT), the program challenges students to work in teams to design and build prototypes of tools to be used by astronauts during spacewalk training in the center's Neutral Buoyancy Laboratory. University students from across the nation participated in space exploration workshops, toured center facilities, and presented their concepts and prototypes for deep-space spacewalks.



JUNE

Ohio Senator Applauds Orion/SLS Suppliers

ESA/Airbus Team Complete ESM CDR

SLS/Orion Team Visits Alabama Suppliers

Space Exploration Summer School Highlights

National Aeronautics and Space Administration



MAY 2016

SPACE LAUNCH SYSTEM HIGHLIGHTS

**ANOTHER
PIECE OF
SLS TEST
HARDWARE
MARKED
COMPLETE**

NASA COMPLETES TEST VERSION OF SLS LAUNCH STAGE ADAPTER

The structural test article of the launch vehicle stage adapter (LVSA) has completed final manufacturing at NASA's Marshall Space Flight Center in Huntsville, Alabama. The LVSA will connect two major sections of the upper part of NASA's Space Launch System – the core stage and the interim cryogenic propulsion stage (ICPS) – for the first flight of the rocket and the Orion spacecraft.

Later this year at Marshall, the test version of the LVSA will be stacked with other structural test articles of the upper part of SLS. Engineers will examine test data and compare it to computer models to verify the integrity of the hardware and ensure it can withstand the forces it will experience during flight. The hardware's cone shape is due to the ICPS having a smaller diameter than the rocket's core stage. Teledyne Brown Engineering of Huntsville is the prime contractor for the LVSA.



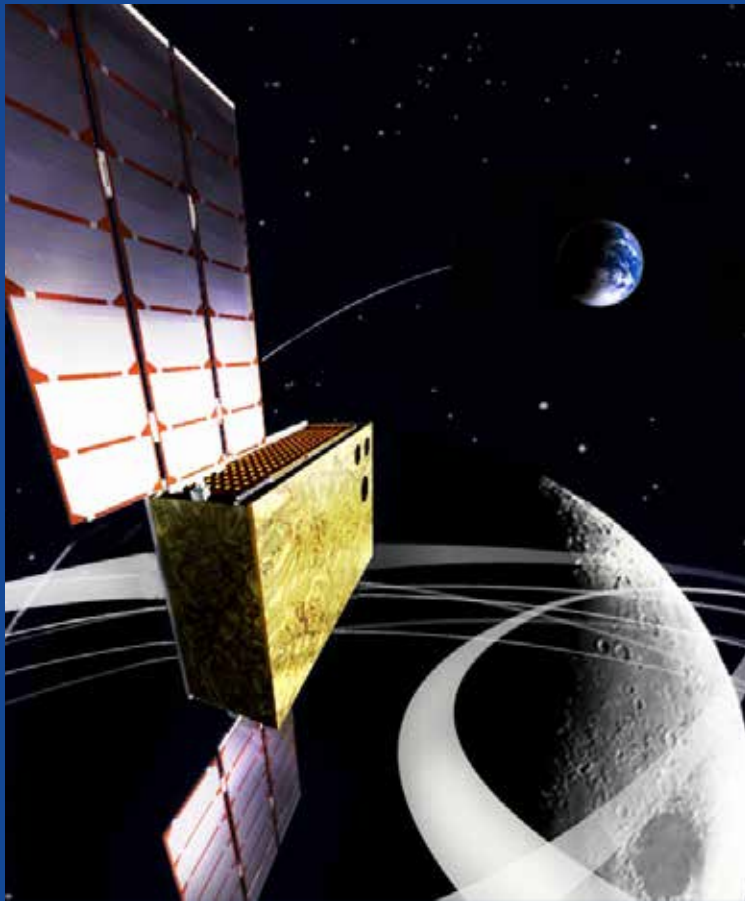
Richard Johnson, a URS Corp. employee supporting Marshall's Engineering Directorate, checks out the massive structural test article of the SLS launch vehicle stage adapter.

INTERNATIONAL PARTNERS PROVIDE SCIENCE SATELLITES FOR AMERICA'S SPACE LAUNCH SYSTEM MAIDEN FLIGHT

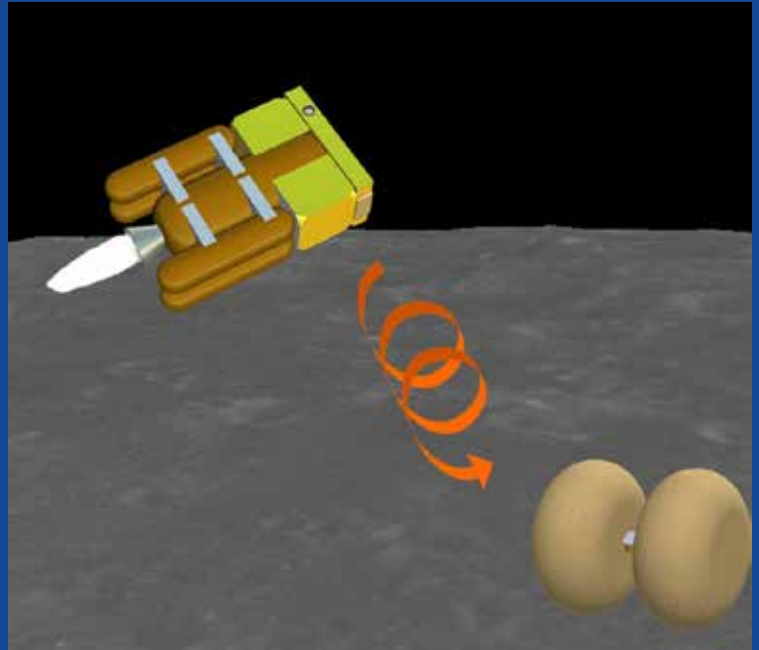
On the first flight of SLS, NASA will take advantage of additional available mass and space to provide the rare opportunity to send more than a dozen small satellites, called CubeSats, to conduct experiments beyond low-Earth orbit. In addition to the 10 CubeSats announced earlier this year, the agency will be sending three from international partners. [Read the full story here.](#)



All 13 secondary payloads will be mounted inside the SLS Orion Stage Adapter, which sits on top of the rocket, just below the Orion spacecraft. The main part of the ring-shaped adapter, shown here, was recently manufactured at the Marshall Center.



EQUULEUS (EQUilibrUM Lunar-Earth point 6U Spacecraft) will measure the distribution of plasma that surrounds the Earth to help scientists understand the radiation environment in the region of space around Earth. It will also demonstrate low-energy trajectory control techniques, such as multiple lunar flybys, within the Earth-moon region. (JAXA/University of Tokyo)



OMOTENASHI (Outstanding MOon exploration TEchnologies demonstrated by NAno Semi-Hard Impactor) will demonstrate the technology for low-cost and very small spacecraft to land on the lunar surface. The CubeSat will also take measurements of the radiation environment near the moon as well as on the lunar surface. (JAXA/University of Tokyo)



ArgoMoon will demonstrate the ability to perform operations in close proximity of the ICPS. It will also record images of the ICPS for historical documentation and to provide valuable mission data on the deployment of other Cubesats. Additionally, this CubeSat will test optical communication capabilities between the CubeSat and Earth. (Argotec)

NASA CELEBRATES LOUISIANA'S CONTINUING ROLE IN HUMAN SPACE EXPLORATION



NASA celebrated the Louisiana workforce's participation on the journey to Mars at NASA Day in Baton Rouge at the Louisiana State Capitol on May 5. At 322 feet tall, the Block 1 SLS will stand about 128 feet shy of the height of the Capitol, which is 450 feet tall and the tallest Capitol in the United States. The SLS core stage is being built at the Michoud Assembly Facility outside New Orleans.



NASA Marshall Space Flight Center Director Todd May and astronaut Steve Bowen address the Louisiana State Senate on NASA Day in Baton Rouge on May 5. Read May's [op-ed](#) in "The Advocate" on the state's contributions to NASA's mission to Mars.

PRECISE MEASUREMENTS ON EARTH ENSURE NASA'S BIG SPACECRAFT WORK IN SPACE

Measurement is the first step that leads to success. If you can't measure something accurately, you can't understand and improve it. That is especially true for giant rockets designed to operate under extreme temperatures and pressures at liftoff or space stations the size of a six-bedroom house that must support people living and working in space for years.

Researchers at the Metrology and Calibration Laboratory at the Marshall Center understand the importance of measurement accuracy, especially for SLS.

"We make sure every instrument that takes measurements during tests for the International Space Station or the Space Launch System or other NASA programs are accurate," said Gary Kennedy, technical representative for the Marshall Metrology and Calibration program. About 96 percent of Marshall's measurement and test equipment is calibrated through the lab in support of center operations, research and development, manufacturing, and testing for NASA projects. Story continues [here](#).



Metrology technician Joey Longino stands on the top of a 25-foot high, 750-thousand pound Gilmore machine to connect power prior to starting the calibration process.

FACES OF SLS: JUSTIN LITTELL

This funny, first-time dad is building test and flight hardware for SLS. Meet Justin Littell, a mechanical engineer at NASA's Marshall Space Flight Center.



SPACEFLIGHT PARTNERS: *Watring Technologies Inc.*



Core Stage

Block 1



LOCATION:

Huntsville, Alabama

NUMBER OF EMPLOYEES: 42

WHAT THEY DO FOR SLS:

Watring provides support to The Boeing Co. on systems engineering, structures analysis, and tooling and cable design for the SLS core stage.



Follow our blog, “[Rocketology](#),” and go behind the scenes with us as we test and build the world’s most powerful rocket for missions to deep space.

Comments and questions will be addressed on the SLS [Facebook page](#).

SLS PART OF NASA GLENN’S 75TH ANNIVERSARY CELEBRATION

A visitor checks out a model of the SLS on the mobile launcher at NASA Glenn Research Center’s first public open house since 2008. The event, held May 21-22, celebrated Glenn’s 75th anniversary. Among the many event activities, participants had the opportunity to walk through wind tunnels – which are crucial to testing environmental factors on rockets like SLS – and see where NASA tests tires for lunar and Mars rovers. ►



FOLLOW THE PROGRESS OF NASA’S NEW LAUNCH VEHICLE FOR DEEP SPACE:

NASA SLS Rocketology Blog....blogs.nasa.gov/Rocketology

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Google+.....[Plus.Google.com/+NASASLS](https://plus.google.com/+NASASLS)

Tumblr.....nasasls.tumblr.com

COMING IN
JUNE:

Second SLS booster qualification test

ICPS delivered to Marshall

NASA in the Park



PROGRAM HIGHLIGHTS • MAY 2016

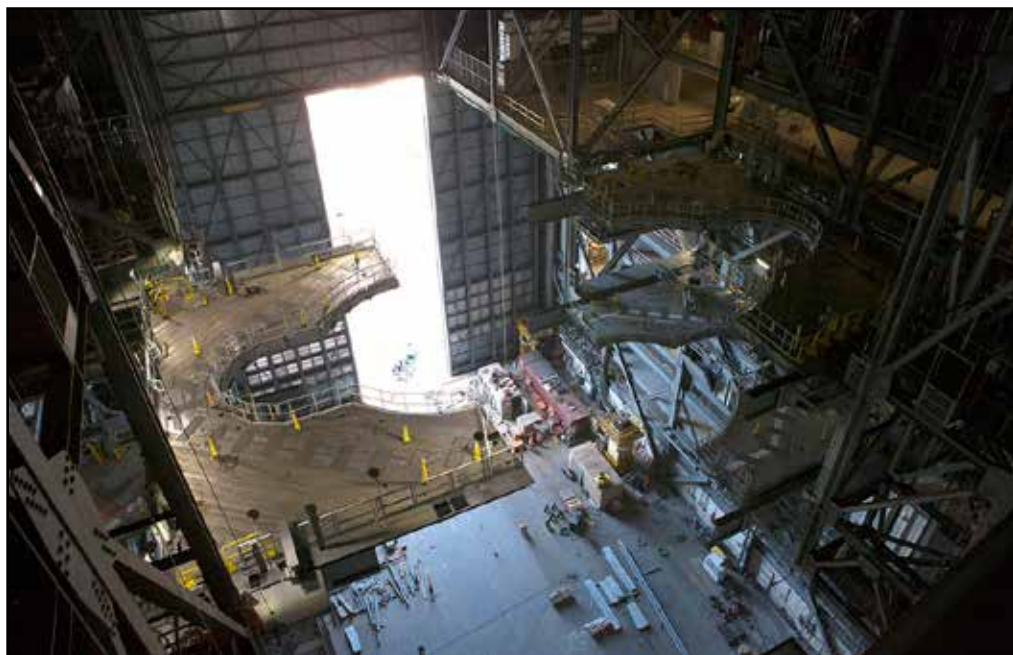
At NASA's Kennedy Space Center in Florida, the Ground Systems Development and Operations (GSDO) Program Office is leading the center's transformation from a historically government-only launch complex to a spaceport bustling with activity involving government and commercial vehicles alike. GSDO is tasked with developing and using the complex equipment required to safely handle a variety of rockets and spacecraft during assembly, transport and launch. For more information about GSDO accomplishments happening around the center, visit <http://www.nasa.gov/groundsystems>.

First Work Platforms Tested for Space Launch System

Kennedy Space Center is one power step closer to processing the agency's Space Launch System (SLS) for its first flight, Exploration Mission 1 (EM-1) and NASA's journey to Mars. During a preliminary test April 28, the two J-level work platforms installed on the north and south sides of Vehicle Assembly Building High Bay 3, where the SLS will be prepared for launch, were successfully activated to test their functionality and simulate how they will surround the massive rocket on the mobile launcher.

"It was an amazing sight to look down and watch as the platform smoothly extended out into the open air of High Bay 3," said Mike Bolger, Ground Systems Development and Operations Program (GSDO) manager. "As each half of the J platforms slowly extended, I couldn't help but think forward to the day when the SLS core stage and boosters will fill the void between the platform halves."

The J-level work platforms are just one of 10 levels of platforms that will surround the SLS rocket and Orion spacecraft in the high bay. The platforms will extend and retract and will have the capability to be adjusted up or down as required to give engineers and technicians access to various areas of the giant rocket, twin solid rocket boosters, Orion and its launch abort system during



For the first time, one of the new work platforms in High Bay 3 inside the Vehicle Assembly Building was powered on April 28. Lights illuminate one half of the J-level platforms as the platform is extended. A preliminary test of both J platforms was completed to verify each platform's push chain system, roller system and electrical connections. In view below is one of the K-level platforms. Photo credit: NASA/Kim Shiflett

processing and testing.

Each of the platform halves are about 62 feet wide and 38 feet long and weigh between 300,000 and 325,000 pounds. The J-level platforms are located about 112 feet above the VAB floor, or nearly 11 stories high, and will provide access

to the SLS booster.

As additional platforms are installed in High Bay 3, they will undergo the same testing to ensure all of the platforms are ready for the first launch.

To read the complete story, visit <http://go.nasa.gov/1XhBuIM>.

Upgrades to Launch Pad 39B Flame Trench in Work

NASA's Space Launch System (SLS) rocket and Orion spacecraft will roar into deep space from Launch Pad 39B at the agency's Kennedy Space Center in Florida. Before the most powerful rocket in the world takes flight, the Ground Systems Development and Operations (GSDO) Program continues making significant upgrades and modifications to the historic pad to accommodate the new rocket's shape and size. Exploration Mission 1 (EM-1) will be the first of many missions of SLS and Orion as the agency prepares for its journey to Mars.

In June 2015, NASA awarded a contract to J.P. Donovan Construction of Rockledge, Florida, to upgrade the flame trench and provide a new flame deflector. This system is critical to safely containing the plume exhaust from the massive rocket during launch. Construction workers have been busy, removing old adhesive material and preparing the walls on the north side of the trench for brick installation.

Construction workers now are preparing the north side of the flame trench to withstand temperatures of up to 2,000 degrees Fahrenheit at launch of the rocket's engines and solid rocket boosters. Approximately 100,000 heat-resistant bricks, in three different sizes, will be secured to the walls using bonding mortar in combination with adhesive anchors.

The new flame deflector will be positioned about six feet south of the shuttle-era flame deflector's position. The north side of the deflector will be protected by a NASA standard coating. The south side of the deflector will not be slanted and will have no lining. The new design will provide easier access for inspection, maintenance and repair.

The two side flame deflectors, repurposed from space shuttle launches, will be refurbished and reinstalled at pad level on either side of the flame trench to help reduce damage to the pad and SLS rocket.

To read the complete story, visit <http://go.nasa.gov/1Y75QxX>.



Construction workers with J.P. Donovan of Rockledge, Florida, prepare to attach new heat-resistant bricks to one of the concrete walls on the north side of the flame trench at Launch Pad 39B on April 14. The Pad B flame trench is being refurbished to support the launch of NASA's Space Launch System rocket. The Ground Systems Development and Operations (GSDO) Program at Kennedy is helping transform the space center into a multi-user spaceport and prepare for Exploration Mission 1, deep-space missions, and the journey to Mars. Photo credit: NASA/Kim Shiflett



Construction workers with J.P. Donovan of Rockledge, Florida, inspect the concrete walls of the north side of the flame trench at Launch Pad 39B on April 14. New heat-resistant bricks have been attached with epoxy mortar to a section of the flame trench wall. Photo credit: NASA/Kim Shiflett

GSDO is Go for Launch with a new Facebook Page.
Check it out at:
<https://www.facebook.com/NASAGoforlaunch/>

Industry Spotlight - PRAXAIR

Praxair was originally founded in 1907. The company's name, adopted in 1992, is from the Greek word "praxis," or practical application, and "air," their primary raw material.

Praxair's headquarters is in Danbury, Connecticut, with a local production facility in Mims, Florida. About 26,000 employees work in more than 50 countries around the world. It was the first company in North America to commercialize cryogenically separated oxygen.

At Kennedy Space Center, Praxair provides liquid hydrogen, liquid oxygen and various packaged gas products. Praxair will supply liquid hydrogen and oxygen for prelaunch test and launch support at Launch Pad 39B for NASA's Space Launch System rocket and the agency's journey to Mars.

The company's goals are to manage their current and future contracts with NASA, and work with NASA and its contractors in support of all missions, both current and future.

"Our goal is to exceed NASA's expectations through critical mission support, continually redefining our capabilities and ability to provide flawless support," said Doreen Heal, Praxair's director of Government Programs.



The PRAXAIR liquid hydrogen (LH2) truck arrives April 28 at the liquid hydrogen tank at Launch Pad 39B at NASA's Kennedy Space Center in Florida. PRAXAIR and engineers and technicians on the Test and Operations Support Contract will review procedures and prepare for a fit check of the new LH2 transfer flex hose. Photo credit: NASA/Frankie Martin

Over the century of its existence, Praxair has led the development of processes and technologies that have revolutionized the industrial gases industry. According to Heal, the company introduced the first distribution system for liquid gas in 1917, and developed onsite gas supply by the end of World War II. In the 1960s, Praxair introduced non-cryogenic means of air separation, and since then has continued to introduce innovative applications technologies for various industries.

"Praxair is very proud of our long and rich history with NASA and the space program. We have been a supplier to Kennedy Space Center from the Apollo era through the last space shuttle launch," Heal said. "We look forward to supporting the dedicated men and women of NASA with their research and vision of future space exploration, and pushing the boundaries of existing space knowledge, not only making our planet more productive, but our universe as well."



Engineers and technicians on the Test and Operations Support Contract go over procedures with liquid hydrogen (LH2) provider PRAXAIR April 28 to prepare for a fit check of the new LH2 transfer flex hose at Kennedy Space Center's Launch Pad 39B. LH2 provider PRAXAIR connected the transfer flex hose from its LH2 truck to the LH2 tanker to confirm that the hose fits and functions properly. The Ground Systems Development and Operations Program is overseeing upgrades and modifications to Pad 39B to support processing of the first integrated launch of the Space Launch System rocket and Orion spacecraft for Exploration Mission 1 and NASA's journey to Mars. Photo credit: NASA/Frankie Martin

Employee Spotlight - Elkin Norena

Elkin Norena is the project engineer for the Range Safety Check-out System, Radio Frequency and Telemetry System and Weather Instrumentation System in the Engineering Directorate at Kennedy Space Center. He is responsible for the management and delivery of various mobile launcher subsystems to support the first integrated launch of the Orion spacecraft and the Space Launch System rocket on Exploration Mission 1 for the Ground Systems Development and Operations Program.

Norena arrived at Kennedy in 2005 and worked for United Space Alliance as an orbiter electrical engineer. He also worked as a mechanical engineer specializing in the orbiter docking system, and then with NASA as an electrical engineer for the space shuttles' solid rocket boosters and external tank.

"The most exciting part of my job is getting to see the systems that will be used for launch go from paper to reality, and being involved in the major decisions that will drive the future of the program," Norena said.

The achievement he is most proud of is meeting and making lasting connection with a vast group of experienced people and working alongside them toward this common goal.



"I wanted to be part of a team that helps develop and operate the next generation of human spaceflight," Norena said. "I look forward to the day we will break the deep-space barrier for humanity and find more new amazing discoveries to enrich our lives here on Earth."

Norena's hometown is Teaneck, New Jersey. His parents moved to Orlando, Florida, when he was 15. He graduated from the University of Central Florida (UCF) in 2003, with a bachelor's degree in computer engineering. He returned to UCF and earned a Master's in Business Administration in 2009.

His first car was a 1991 red Honda Accord that started all of his car troubles.

He and his wife, Jessica, met at UCF. They celebrated their ten-year anniversary in April. They have two daughters, Emma, 6, and Raquel, 5.

Some of his hobbies include tinkering with old and new technology (home entertainment and drones), finding crazy deals, like an LCD television for under \$100, and spending time with his family.



One of the Orbital ATK aft skirts for NASA's Space Launch System's solid rocket booster is on its way to Hangar AF at Cape Canaveral Air Force Station in Florida on April 25 to be stripped and painted. Photo credit: NASA

